
4.5 GEOLOGY

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INTRODUCTION

This section analyzes the effects of the proposed Vista Oaks and Highlands Parcel A subdivisions upon soils and geology within the project area. Much of the analysis focuses on the surface grading required for development of the proposed projects. The Geology section also discusses the potential for erosion of topsoil during construction and the effect that expansive soils would have on the development.

Information in this chapter is drawn from a *Preliminary Soils Report* (Appendix I) prepared by Blackburn Consulting, Inc. (December 2001)¹, a *Phase I Environmental Site Assessment* (Appendix J) undertaken by Terra Search, Inc. (November 2001)², a *Feasibility Geotechnical Report* (Appendix K) prepared by Anderson Geotechnical Consultants, Inc. (October 1989)³, and a *Geotechnical Engineering Study - Update* (Appendix L) prepared by Youngdahl & Associates, Inc. (September 1999)⁴. Pertinent comments received in response to the Notice of Preparation (NOP) for the proposed projects have been integrated into the analysis.

ENVIRONMENTAL SETTING

The following background setting information focuses on the existing topography of the project sites, the underlying bedrock, and site seismicity, as well as past mining activity and the general conditions and expansiveness of the on-site soils.

Topography

Granitic rock types and sedimentary rocks form the regional tectonic structure, which consists also of the volcanic Mehrten formation and alluvial materials. As described in the City of Rocklin General Plan EIR, the Rocklin area is “located within the Loomis Basin, which is situated in the western foothills of the Sierra Nevada Range. The Sierra Nevada is a large fault block composed of granitic and metamorphic rocks tilted gently from the summit near Donner Lake to the west where the block dips under sedimentary and alluvial units of the Sacramento Valley.”

As identified by the Phase I Environmental Site Assessment, the topography of the Vista Oaks project sites slopes downward gradually to the west. The site is relatively flat on both the east and west sides of Secret Ravine Creek. The topography of the site consists of hillsides further to the east of Secret Ravine Creek. The elevation of the site is changing from approximately 300 feet above mean sea level (msl) on the eastern portion to approximately 160 feet msl on the southwestern portion of the site. Drainage appears to follow the local topography from east to west and southwest. Secret Ravine Creek is located in the middle of the site, flowing from northeast to southwest.

The topography of the Highlands Parcel A site generally slopes downward from a ridge to the south of the site. The south-central and east-central portions of the site are relatively flat ridges and the land slopes away from these ridges more steeply to the west, north, and east. Elevation of the site varies from approximately 280 feet above mean sea level (msl) in the southeastern portion of the site to approximately 200 feet msl in the northwestern portion of the site. Drainage appears to follow the topographical contours from the south to the north and west. Secret Ravine Creek runs east to west, close to the northern border of the site. An ephemeral creek runs from the north to the south in the eastern portion of the site (Raney Planning & Management, 2005).

Underlying Bedrock

Geologic conditions at the Vista Oaks and Highlands Parcel A project sites are dominated by four different geologic units, which include the following: (1) granitic rock (Mesozoic diorite); (2) sandstone, conglomerate and volcanic mudflow breccia of the Tertiary Mehrten Formation; (3) silt, sand and gravel of the Quaternary Turlock Lake Formation; (4) recent alluvial deposits associated with stream terraces and active stream channels. A short description of each unit is described below.

Granite (Mzd)

Granite is the oldest rock unit on the site and was emplaced over 140 million years ago. The granite (or more specifically “diorite”) is exposed in the northeastern portion of the site. Exposures are typically gray-brown and very hard. This rock is usually very weathered and forms a residual cover of silty-sandy soil. Typically, hard (less-weathered) granite is 4 to 7 feet below the surface; however, unweathered isolated knobs can be much shallower. A number of rounded, unweathered knobs of granite protrude up to 10 feet or more above the project site surface.

Mehrten Formation (Tmv and Tvc)

Much of the site is underlain by rock of the Mehrten Formation. This material consists of sandstone, conglomerate and a hard volcanic mudflow breccia deposited in association with volcanic activity 10 to 20 million years ago. The Mehrten Formation in the area is divisible into two separate units. The first and most prominent unit includes a hard, gray volcanic mudflow breccia approximately 35 feet thick. The other unit consists of moderately well cemented, gray-brown sandstone and conglomerate. The sandstone and conglomerate lies both above and below the volcanic mudflow breccia. Both units are found throughout the eastern half of the project site.

Turlock Lake Formation (Qtl)

Sediments of the Turlock Lake Formation are found mostly along the northwestern portion of the project site. This formation consists of Pleistocene (last 1.5 million years) terrace deposits of slightly cemented silt, sand, and gravel.

Recent Alluvium (Qal)

Recent alluvial deposits of gravel, sand, silt, and clay are found in the stream channels and lower flat lying areas, mostly along Secret Ravine Creek. These alluvial deposits are generally loose to moderately dense.

Site Seismicity

The Vista Oaks and Highland Parcel A project sites are generally considered to lie in an area of relatively low seismic activity. Active faults have not been identified on or adjacent to the property. The principal fault zones near the area are the Bear Mountain fault zone, approximately 13 miles northeast of the site, and the Melones fault zone approximately 7 miles to the northeast. Studies performed by Woodward-Clyde Consultants near the Auburn Dam site and by Tierra Engineering Consultants near Folsom Lake indicate that the east branch of the Bear Mountain fault zone should be considered as being potentially active and capable of producing an earthquake of magnitude 6.0 to 6.5 on the Richter scale. The Melones fault zone is also considered to be potentially active. Although these fault zones have been considered for special zoning accordance with the Alquist-Priolo Act of 1972, the State of California did not feel there was a need to designate the fault areas as Special Study Zones.

The Bear Mountain and Melones fault zones represent shearing that occurred in the western Sierra Nevada during the Mesozoic Era (70 to 190 million years ago). An earthquake event could conceivably occur along the Bear Mountain fault zone. The risk of surface rupture at the project site would be remote. However, ground shaking due to seismic activity along nearby active faults could produce ground shaking at the site.

Secondary seismic effects such as liquefaction and lateral spreading are not considered potential hazards at the site due to the relatively thin surface soil and hard rock or cemented soil underlying most of the site. Within the low-lying, recent alluvial deposits, liquefaction could be a potential hazard due to the loose sands and near surface groundwater. In the event of strong seismic shaking at the site, some lurch cracking may develop but should not result in major structural damage. Due to the proximity of the site to several extensions of the Foothills Fault System, ground shaking from seismic activity should be carefully considered in the design and construction of the project. The risks of damage to structures due to ground shaking should be minimized when structures are constructed in accordance with the current Uniform Building Code. According to the Preliminary Soils Report, other geologic hazards such as regional and local subsidence are thought to be non-existent.

Soil Conditions

The nature of the surface soil on the project sites varies considerably with the geologic units. The following are descriptions of the types of soils found on the Vista Oaks and Highland Vista sites:

Mzd: Approximately one to three feet of brown, moderately dense sandy silt/silty sand overlies a brown to gray-brown, dense silty sand. The soil grades to a moderately weathered granite at depths, typically 4 to 7 feet in depth.

Tmv and Tmc: The surface soil generally consists of .5 to 1.5 feet of red-brown, moderately dense, sand silt with clay. This overlies either the gray, volcanic mudflow breccia or the cemented conglomerate and sandstone. Both of these underlying units are very hard and difficult to excavate.

Qtl: Typically, 7 to 8 feet of a brown, moderately dense, slightly cemented, silty, medium to coarse-grained sand overlies a brown to gray-brown sand with some silt. The sand can be silty/clayey near the surface.

Qal: This unit usually consists of a gray, loose to moderately dense, medium to coarse-grained sand with some silt. Clayey lenses often exist at various depths in this unit.

According to the United States Department of Agriculture Soil Survey (See Figure 4.5-1), the soils types on the Vista Oaks and Highlands Parcel project sites are described as follows:

Cometa-Ramona sandy loams, 1 to 5 percent slope: The Cometa soil is a deep, well drained claypan soil that formed in alluvium, mainly from granitic sources. The Ramona soil is very deep and well drained and is formed in alluvium from predominately granitic sources.

Inks Cobbly loam, 2 to 30 percent slope: This is a shallow, well drained cobbly soil underlain by andesitic conglomerate. Typically, the surface layer is yellowish brown cobbly loam about 5 inches thick. The subsoil is brown very cobbly clay loam.

Xerofluvents, frequently flooded: Xerofluvents, frequently flooded, consist of narrow stringers of somewhat poorly drained recent alluvium adjacent to stream channels. Natural vegetation is annual grasses, forbs, sedges, valley oak, and willow.

Xerorthents, placer areas: This soil consists of stony, cobbly, and gravelly material commonly adjacent to streams that have been placer mined. Natural vegetation varies but generally is annual grasses, browse, oak, alder, willow, and cottonwood.

Expansive Soil

The surface soil observed in some areas of the project sites may be potentially expansive. Expansive soil creates the potential for inconsistent soil settlement when bearing structural weight. Much of the soil overlying the Mehrten Formation (Tmv and Tmc) consists of sandy silt with clay, which can be potentially expansive.

Vista Oaks and Highlands Parcel A Soils Map



Source: USDA Soil Survey of Placer County, California. 1977.

Surface Water and Groundwater

Secret Ravine Creek typically flows year-round. Shallow groundwater is expected to occur in the low-lying area surrounding Secret Ravine. Groundwater could be expected at or near the elevation of the water in the creek. A freshwater seep has been identified just south of Interstate 80 about 500 feet beyond the end of China Garden Road⁵. Various features in this area (such as gullies emanating from the sides of shallow slopes) indicate that there is likely to be water at the surface during wetter times of the year. Surface water in this area can occur where water perched above the underlying granitics is forced to the surface.

REGULATORY CONTEXT

Existing policies, laws and regulations that would apply to the proposed projects are summarized below.

State

California Building Standards Code / Uniform Building Code

Site development and design are regulated in the State of California by the California Building Standards Code (CBC), based on the federal Uniform Building Code (UBC) and suited to the unique sensitivity of the state's geology and faultlines. CBC and UBC regulations must be complied with in consideration of expansive soils, drainage, erosion, earthquake resistance, and required safety measures during on-site development. Geologic and soils conditions would also determine the proper installation of underground communications and utility lines.

Local

City of Rocklin General Plan

The following are existing policies, laws, and regulations established in the 1991 City of Rocklin General Plan, as applicable to the geological resources of the proposed Vista Oaks project:

Community Safety Element⁶

Goal	To minimize the danger of natural and man-made hazards and to protect residents and visitors from the dangers of earthquake, fire, flood, and other natural disasters, and man-made dangers.
Policy 1	To require engineering analysis of new development proposals in areas with possible soil instability, flooding, earthquake faults, or other hazards, and to prohibit development in high danger areas.
Policy 7	To prohibit development along stream channels that would adversely reduce the stream capacity, increase erosion, or cause deterioration of the channel.
Policy 11	To limit development in areas with severe slopes.

Southeast Rocklin Circulation Element

The following are existing policies, laws, and regulations established in the Southeast Rocklin Circulation Element, as applicable to the geological resources of the proposed Vista Oaks project:

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|-----------|---|
| Policy 6 | Adopt and enforce design principles to reduce the impact of new development on the existing natural terrain and built environment. |
| Policy 31 | Hydroseed areas adjacent to finished roadbeds that were disturbed during construction to promote vegetation and reduce erosion potential. |
| Policy 34 | Set aside topsoil for later use in revegetation and recontouring efforts, while grading prior to road construction. |
| Policy 52 | Sweep and collect from adjacent streets any project related soil and debris. |

Vista Oaks Grading Design Guidelines

The following are grading criteria that will be administered by City staff in reviewing the design and development of the Pad Graded and Limited Graded lots. The guidelines have been developed in order to tailor grading activities to existing conditions of the Vista Oaks project site:

A. Grading and Drainage

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| Guideline 1 | The grading plan prepared for the site shall identify all areas that are proposed to be disturbed as part of the grading operation. Grading is considered any cut or fill proposed on a site. |
| Guideline 2 | Grading for the home design shall be governed by the criteria listed in Section 7. |
| Guideline 3 | Steep exposed cuts (2:1 or greater) visible from offsite are to be avoided when feasible. The grading plan should incorporate either retaining walls or natural contouring to blend the developed site with the natural terrain of the lot. See Exhibit C for an example of a conceptual grading plan. See Section 6D for specific details on retaining wall criteria. |
| Guideline 4 | The area to be graded or shaped will be kept to the minimum area necessary to accommodate the home, garage, and a minimal backyard, generally flat and approximately 20 feet in depth, directly adjacent to the house. Backyard areas may be located away from the house to take advantage of flatter areas on the site. Backyard areas must be located below the highest plate line of the home on the site. The transitional edge of backyard areas will be achieved through contour grading or the use of retaining walls. See Section 6D for an illustration of retaining wall criteria. See Exhibit D for examples of appropriate siting of backyard areas. |
| Guideline 5 | Grading and drainage criteria shall emphasize reducing erosion, runoff, and adverse effects to water quality in natural drainage channels. |
| Guideline 6 | Grading patterns created by the subdivision improvements should be maintained and implemented through design of the home and associated improvements. |

B. Driveways

- Guideline 1 Driveway alignment and slope should conform to the natural topography as much as possible in order to minimize cut and fill slopes.
- Guideline 2 Minimized driveway widths from the curb in order to reduce the visual impact of extensive pavements and minimize tree removal.

C. Building Design

- Guideline 1 Design of the home and the ultimate site plan will be driven by the topography (slope) on the individual lot. The goal is to design the structure to the lot, and not the site to the structure.
- Guideline 2 Stepped foundation and terraced building floor levels shall be utilized to conform to the hillsides.
- Guideline 3 The foundation criteria in Section 7 shall be utilized in the design of homes on the lots covered by these guidelines..

D. Retaining Walls

- Guideline 1 Retaining walls are encouraged and in some cases required as a way of blending the graded or developed environment with the natural contours of the land.
- Guideline 2 Retaining walls may be used as a means of adapting to varied topographic conditions and shall consist of compatible colors, texture, and materials used on the residence or adjacent environment. Use of rock, native stone veneers, or heavy wood timber is encouraged. Crib wall and standard concrete block are generally unacceptable.
- Guideline 3 The following table outlines the retaining wall criteria that will be adhered to on "Limited Graded" lots at Vista Oaks.

Grade of Lot	Max. wall height for a single wall	Max. wall height in series	Min. bench width between walls*	Max. number of walls in series
0-8 %	4.5 feet	3 feet	1.5 feet	3
9-16%	6 feet	4 feet	4 feet	3
17+ %	8 feet	6 feet	6 feet	2**

* Or as approved by a soils or geotechnical engineer.

** The maximum number of walls may be increased by 1 when the maximum wall height in series is 12 feet or less. Minimum bench requirements will be adjusted based on wall heights.

- Guideline 4 The Community Development Director or the Chief Building Inspector may grant minor variations to these standards for specific on-site topographic constraints.
- Guideline 5 Walls necessary for driveway encroachment cuts or fills into a parcel may exceed the maximum height for a single wall as follows:
0-25% 1.25 times higher than maximum single wall height.
- Guideline 6 All walls over 3 feet or walls built in series will be constructed of masonry materials such as concrete, stucco, stone, or similar materials.

E. Landscaping and Fencing

- Guideline 1 Rear yard fencing adjacent to open space shall be wrought-iron fencing and meet current pool fencing criteria, except where masonry sound walls are required as a means of noise attenuation.
- Guideline 2 Foundations and undersides of structures on hillsides shall be screened with

- landscaping to avoid exposed underfloor areas.
- Guideline 3 Protect and preserve desirable native vegetation in order to preserve the overall natural character of the project area.

F. Oak Trees

- Guideline 1 Oak trees shall be preserved to the extent feasible.
- Guideline 2 Oak tree removal permits will not be issued until approval of a house site plan by the Planning Department.
- Guideline 3 To the extent that grading is required around oak trees that are to be preserved, the designer/homebuilder shall retain the services of a certified arborist to prepare design details and recommendations for the preservation of any oak tree that could be impacted by grading operations on site. All recommendations of the arborist must be incorporated into the final design of the project.

IMPACTS AND MITIGATION MEASURES

The geological impacts related to the proposed projects are analyzed and assessed in this section.

Standards of Significance

An impact on the geology of the Vista Oaks and Highlands Parcel A sites would be considered significant if any of the following conditions would potentially result from the proposed projects' implementation:

- Substantial alteration of the existing topography through significant grading activities;
- Exposure of people or structures to substantial, adverse effects as a result of strong groundshaking, seismic-related ground failure, liquefaction, lateral spreading, landslides, or lurch cracking;
- Substantial erosion or unstable slope or soil conditions through alteration of topographic features, dewatering, or changes in drainage patterns; or
- Exposure of people, structures, or infrastructure components to increased risk of injury or damage due to the presence of expansive soils, soil settlement/compaction, or other geotechnical constraints.

Method of Analysis

The analysis for the proposed Vista Oaks and Highland Parcel A subdivisions relies on an Environmental Site Assessment undertaken by Terra Search, Inc. (November 2001), as well as a Preliminary Soils Report from Blackburn Consulting, Inc. (December 2001) and a Feasibility Geotechnical Report by Anderson Geotechnical Consultants, Inc (October 1989), and a Geotechnical Engineering Study - Update prepared by Youngdahl & Associates, Inc. (September 1999).

Project-Specific Impacts and Mitigation Measures

4.5I-1 Impacts related to slope stability.

Vista Oaks

Topography varies significantly across the project site. The northwest half of the site is relatively flat and includes Secret Ravine Creek and its associated alluvial deposits. Topographic relief across this portion of the site is generally only 5 to 10 feet. The topography of the southeastern portion of the project site is quite different. Steep, northerly facing, natural slopes with gradients of approximately 5:1 to 2:1 (horizontal to vertical) border the flat lying portion. However, most of the higher slopes on the site consist of Mehrten Formation sandstone conglomerate and volcanic mudflow breccia. Because this formation is relatively flat lying and typically well cemented, slope stability is not considered a potential hazard (Anderson Geotechnical Consultants, Inc, p. 5). However, without appropriate drainage and vegetation measures to minimize erosion of slope soils, slope stability could decline.

Highlands Parcel A

The topography of the Highlands Parcel A site generally slopes downward from a ridge to the south of the site. The south-central and east-central portions of the site are relatively flat ridges and the land slopes away from these ridges more steeply to the west, north, and east. Elevation of the site varies from approximately 280 feet above mean sea level (msl) in the southeastern portion of the site to approximately 200 feet msl in the northwestern portion of the site. The steepest slopes on the project site range from 20 to 30 percent. However, most of the higher slopes on the site consist of Mehrten Formation sandstone conglomerate and volcanic mudflow breccia. Because this formation is relatively flat lying and typically well cemented, slope stability is not considered a potential hazard. However, without appropriate drainage and vegetation measures to minimize erosion of slope soils, slope stability could decline.

Conclusion

Policy 6 of the Southeast Rocklin Circulation Element requires the City to enforce design principles to reduce the impact of new development on existing natural terrain. Policy 31 requires hydroseeding of areas adjacent to roadbeds to reduce erosions potential, and policy 34 requires the setting aside of topsoil removed by grading for later use in revegetation and recontouring efforts. However, because the lack of appropriate drainage and vegetation measures to minimize erosion of slope soils could result in slope instability on the Vista Oaks and Highlands Parcel A project sites, a *potentially significant* impact could occur.

Mitigation Measure(s)

Implementation of the following mitigation measure would reduce the potential impacts to a *less-than-significant* level.

The following mitigation measures are identified for the Vista Oaks and Highlands Parcel A projects.

4.5MM-1 Prior to the approval of Improvement Plans, geotechnical studies shall be completed for anticipated development of the major roads, to evaluate soil and rock conditions to provide allowable gradients for cut and fill slopes as well as appropriate construction techniques. The studies shall be submitted for the review and approval of the City Engineer.

The developer shall submit Improvement Plans for the review and approval of the City Engineer prior to any grading on the project site. The City Engineer's review shall include but not be limited to the following:

- *Fill placed on slopes steeper than a 6:1 slope gradient (horizontal to vertical), shall be provided with a base key at the toe of the fill slope. The base key shall extend approximately two feet (vertically) into firm material. Fill slopes constructed on the site are expected to be stable if they are constructed on gradients no steeper than 2:1 (horizontal to vertical) and are provided with a base key.*
- *Cut slopes in surficial soil or stream deposits shall not exceed a 2:1 gradient. Cut slopes in underlying rock may be stable at gradients up to 1.5:1 depending on the degree of cementation, groundwater seepage, and the orientation of fractures.*

4.5I-2 Impacts related to grading/alteration of topography.

Vista Oaks

Project site topography varies significantly. Topographic relief across the northwest half of the site is generally only 5 to 10 feet. The topography of the southeastern portion of the project site consists of steep, northerly facing, natural slopes with gradients of approximately 5:1 to 2:1 (horizontal to vertical), which border the flat lying portion. Because of the variety of topography and natural features located within the project boundary, the grading plan prepared for the project by Terrance E. Lowell & Associates, Inc. has taken into consideration the natural topography of the project site. As a result, proposed grading activities would be limited to construction of

proposed roadway improvements and pad grading, which would involve the grading of a total of 32 acres of the 93-acre project to accommodate the various types of graded lots and project roadways (see Figures 4.5-2 and 4.5-3).

Grading concepts have been developed in order to tailor grading activities to existing conditions. In addition, the Vista Oaks project would comply with the erosion control and site preparation requirements of the CBC, UBC, the City's Construction Specifications, Improvement Standards, Standard Drawings, the Vista Oaks Grading Design Guidelines, Best Available Technologies/Best Management Practices (BATs/BMPs), and the Southeast Rocklin Circulation Element policy 6, which would help to reduce impacts related to grading and alteration of the topography.

Highlands Parcel A

The topography of the Highlands Parcel A site generally slopes downward from a ridge to the south of the site. The south-central and east-central portions of the site are relatively flat ridges and the land slopes away from these ridges more steeply to the west, north, and east. The steepest slopes on the project site range from 20 to 30 percent. Because of the variety of topography and natural features located within the project boundary, the grading plan prepared for the project by Terrance E. Lowell & Associates, Inc. has taken into consideration the natural topography of the project site. As a result, proposed grading activities would be limited to construction of proposed roadway improvements and pad grading, which would involve the grading of a total of 7.27 acres of the 30.1-acre project to accommodate the various types of graded lots and project roadways (see Figure 4.5-3). Grading concepts have been developed in order to tailor grading activities to existing conditions. In addition, the Highlands Parcel A project would comply with the erosion control and site preparation requirements of the CBC, UBC, and the City's Construction Specifications, Improvement Standards, Standard Drawings, Best Available Technologies/Best Management Practices (BATs/BMPs), and the Southeast Rocklin Circulation Element policy 6, which would help to reduce impacts related to grading and alteration of the topography.

Conclusion

Because the proposed grading would be limited to construction of roadway improvements and pad grading, and would comply with the CBC, UBC, and the City's BMPS, as well as the Southeast Rocklin Circulation Element policies, impacts to topographic features would be considered *less-than-significant*.